MONITORING REPORT

"Biomass based steam generation project by Sterling Agro Industries Ltd."

Verified Emission Reductions (VERs)
Under VCS-2007.1

25th April 2009- 5th February 2010
(Both days included)

Monitoring Report
Version: 1.2
Date: 20th July 2010

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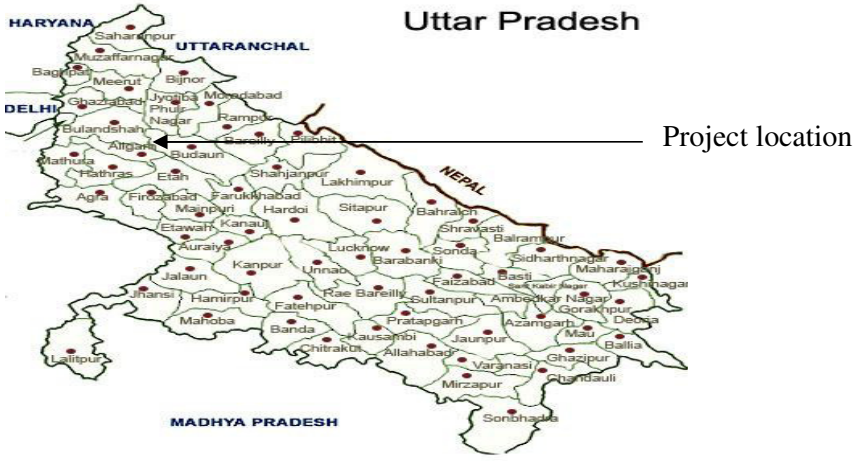
1. Project details:

- **CDM PDD Version & date:** Version 1.3; 31st August 2009
- **CDM Methodology Version:** AMS I C "Thermal energy for the user with or without electricity"; Version 13, Sectoral Scope 1 (EB 38)
- **Project Commissioning:** 25th April 2009[1]
- **Project registration date:** 6th February 2010
- **Project registration no:** 2952[2]
- **Crediting period: 6th February 2010 to 5th February 2020**
- **Monitoring Period:** From 25th April 2009 till 5th February 2010

2. Project Description:

Sterling Agro Industries Ltd. (Sterling) has undertaken a project activity, which entails thermal energy generation using renewable fuels. The project activity was implemented at Dairy products manufacturing unit at Bhitouna, Kasganj-Soron Road, Dist-Kanshiram Nagar, Uttar Pradesh. The project proponent installed 15 TPH biomass based boiler which avoids the use of coal in steam generation. Since rice husk is available in the region in surplus, 100% rice husk was used as fuel for entire monitoring period.. Design Technical specification and other details of the Boiler is given below –

Type	**Semi outdoor, Bi drum, water tube, AFBC boiler**	
Capacity	15	TPH
Steam Pressure	21	kg/cm^2
Steam Temperature	216.35 (Saturated)	^0C
Condensate temperature	105	^0C
Make	Cheema Boiler	



Project location

[1] The commissioning trial of the boiler was started on 10th February 2009 and the plant was successfully commissioned and handed over to PP on 24th April 2009. The commercial operation of the boiler was started on 25th April 2009.

[2] http://cdm.unfccc.int/Projects/DB/SGS-UKL1251986974.66/view

3. Implementation of the project activity:

The commissioning trial of the boiler was started on 10th February 2009 and the plant was successfully commissioned and handed over to PP on 24th April 2009. The commercial operation of the boiler was started on 25th April 2009. The plant was in operation continuously since commissioning, No equipment has been replaced and exchanged during the monitoring period. Further no breakdown was observed during the present monitoring period. The outage was taken for the project activity during the present monitoring period for the maintenance of the Dairy plant (i.e. from 1st June 2009 to 15th June 2009.).

4. Monitoring Parameters:

Data / Parameter:	**$Q_{steam, i}$**
Data unit:	tonnes
Description:	Quantity of steam generated
Source of data to be used:	Onsite measurement
Value of data	83808
Description of measurement methods and procedures to be applied:	Directly measured using steam flow meter. Data was monitored on daily basis.
QA/QC procedures to be applied:	Steam flow meter was calibrated annually.
Any comment:	-

Data / Parameter:	**$T_{steam,i}$**
Data unit:	degree C
Description:	Temperature of steam
Source of data to be used:	Onsite measurement
Value of data	217.67
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. The data was monitored on shift basis. The average of the shift wise data is reported here.
QA/QC procedures to be applied:	Gauge was calibrated annually.
Any comment:	The average of the recorded steam temperature is 217.67 degree C which is slightly in higher side as compared to design temperature (i.e Saturated temperature), therefore being on conservative side the saturated temperature (216.359 degree C) is considered for ER calculation.

Data / Parameter:	**$P_{steam,i}$**
Data unit:	kg/cm^2
Description:	Pressure of steam
Source of data to be used:	Onsite measurement

Value of data	21.25
Description of measurement methods and procedures to be applied:	Measured using on-site pressure gauge. The data was monitored on shift basis. The average of shift wise data is reported here.
QA/QC procedures to be applied:	Gauge was calibrated annually.
Any comment:	The average of the recorded steam pressure is 21.25 kg/cm^2 which is slightly in higher side as compared to design pressure (i.e 21kg/cm^2), therefore being on conservative side the monthly minimum recorded pressure is considered for ER calculation.

Data / Parameter:	**$E_{steam,i}$**
Data unit:	kcal/kg
Description:	Enthalpy of steam generated
Source of data to be used:	Estimated based on steam temperature and pressure using steam table.
Value of data	668.78
Description of measurement methods and procedures to be applied:	Estimated value based on steam temperature and pressure. Data was monitored on shift basis.
QA/QC procedures to be applied:	This is an estimated value. No need of QA/QC procedure.
Any comment:	The enthalpy of the steam is estimated based on monthly minimum steam pressure and saturated steam temperature.

Data / Parameter:	**$T_{FW,i}$**
Data unit:	degree C
Description:	Temperature of feed water in to boiler
Source of data to be used:	Onsite measurement
Value of data	79.43
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. The data was monitored on shift basis. The average of the shift wise recorded data is reported here.
QA/QC procedures to be applied:	Gauge was calibrated annually.
Any comment:	The average of the recorded feed water temperature is 79.43 degree C which is lower than the design feed water temperature (i.e 105 degree C). Being on conservative side the design feed water temperature 105 degree C is considered for ER calculation.

Data / Parameter:	**$E_{FW,i}$**
Data unit:	kcal/kg
Description:	Enthalpy of feed water in to boiler
Source of data to be used:	Estimated based on feed water temperature using steam table.
Value of data	79.43
Description of measurement	Estimated value based on feed water temperature. The data was monitored on shift basis. The average of the shift wise recorded data is

methods and procedures to be applied:	reported here.
QA/QC procedures to be applied:	This is an estimated value. No need of QA/QC procedure.
Any comment:	The average of the recorded feed water enthalpy is 79.43 kcal/kg which is lower than the design feed water enthalpy (i.e 105 kcal/kg). Being on conservative side the design feed water enthalpy 105 kcal/kg is considered for ER calculation.

Data / Parameter:	**$Q_{biomass,i,y}$**
Data unit:	tonnes
Description:	Quantity of biomass type i combusted in year y
Source of data to be used:	On-site measurement
Value of data	25,670
Description of measurement methods and procedures to be applied:	Quantity of biomass used in project activity was measured using weigh scales and recorded in Log books.
QA/QC procedures to be applied:	The data was cross checked with the biomass procurement data. The money ledger on purchase of fuel item is submitted to DOE. The ledger contains the biomass invoice details, quantity of rice husk purchased and price of rice husk.
Any comment:	-

Data / Parameter:	**$Q_{fossil,I,y}$**
Data unit:	tonnes
Description:	Quantity of fossil fuel of type i combusted in year y
Source of data to be used:	On-site measurement
Value of data	**0**
Description of measurement methods and procedures to be applied:	Quantity of fossil fuel used in project activity was measured using weigh scales and recorded in Log books.
QA/QC procedures to be applied:	The data was cross checked with the fossil fuel procurement data. The money ledger on purchase of fuel item is provided to DOE. No fossil fuel was fired & purchased during the current monitoring period.
Any comment:	No fossil fuel was fired & purchased during the current monitoring period.

Data / Parameter:	$NCV_{biomass,i}$
Data unit:	kcal/kg
Description:	Net calorific value of biomass of type i used
Source of data to be used:	Plant laboratory
Value of data	2621
Description of measurement methods and procedures to be applied:	Measurement was done in plant laboratory using Bomb calorimeter. The data were monitored annually. A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured.

	Electrical energy is used to ignite the fuel, as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The temperature of the water allows for calculating calorie content of the fuel. The CV measured by the Bomb calorimeter is Gross Calorific value. The conversion of GCV to NCV would be carried out by analyzing fuel characteristics and using algorithm as per IPCC-2006 guidelines, Volume-2 (Energy), Chapter-1(Introduction), page no-1.17.
QA/QC procedures to be applied:	Bomb calorimeter was calibrated annually.
Any comment:	-

Data / Parameter:	$NCV_{ff,i}$
Data unit:	kcal/kg
Description:	Net calorific value of fossil fuel of type i used
Source of data to be used:	Plant laboratory
Value of data	No fossil fuel was fired during the monitoring period.
Description of measurement methods and procedures to be applied:	Measurement was done in plant laboratory using Bomb calorimeter. The data were monitored annually. Measurement will be done in plant laboratory using Bomb calorimeter. The data will be monitored annually. A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured. Electrical energy is used to ignite the fuel, as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The temperature of the water allows for calculating calorie content of the fuel. The CV measured by the Bomb calorimeter is Gross Calorific value. The conversion of GCV to NCV would be carried out by analyzing fuel characteristics and using algorithm as per IPCC-2006 guidelines, Volume-2 (Energy), Chapter-1(Introduction), page no-1.17.
QA/QC procedures to be applied:	Bomb calorimeter was calibrated annually.
Any comment:	No fossil fuel was fired & purchased during the current monitoring period.

Data / Parameter:	Biomass availability
Data unit:	tonnes
Description:	Surplus biomass availability in the region
Source of data to be used:	Sterling Agro Industries Ltd. has carried out its own assessment through external experts. PP appointed a consultant "Enviroaid" for the Biomass assessment study. The assessment was conducted in a radius of 100 km from the plant site. It is evident from the assessment study that rice husk is available in surplus in the study area and surplus percentage is 110% including the rice husk consumption in this project activity.
Value of data	-
Description of measurement methods and procedures to be applied:	-
QA/QC procedures	No need of QA/QC procedure

to be applied:	
Any comment:	

Data and parameters available at the time of validation and fixed ex-ante

SN	Description	Value	Unit	Reference/Remarks
1	Coal emission factor	tCO2/TJ	96.1	IPCC default value and it is fixed ex-ante
2	The efficiency of the baseline coal fired boiler	%	100%	As per AMS-IC, Version 13

5. Formula Used:

Formula and calculations are as per AMS **IC: "Thermal energy for the user with or without electricity";** Version 13, Sectoral Scope 01, EB-38 (dated 28th March 2008), which are explained in Annex I

Baseline Emissions: Baseline emission is calculated using following equation:

$$BE_y = HG_y * EF_{CO2} / \eta_{th}$$

The data required for the baseline emission calculation, their monitoring frequency & value considered for the ER calculation is tabulated below:

Parameter	Description	Monitoring frequency as per the registered PDD	Monitoring frequency as per actual	Monitored Value	Value considered for ER calculation
$Q_{steam,i}$	Quantity of steam generated	Daily	Daily	83808 tonnes	83808 tonnes
$T_{steam,i}$	Temperature of steam	Daily	Shift basis (8 hours in a Shift)	217.67 degree C (average of shift wise data)	216.35 degree C (Saturated temperature)
$P_{steam,i}$	Pressure of steam	Daily	Shift basis	21.25 kg/cm^2 (average of shift wise data)	Monthly minimum recorded pressure.
$E_{steam,i}$	Enthalpy of Steam	Daily	Shift basis	668.84 kcal/kg	Monthly minimum of steam pressure and saturated temperature has been considered to estimate enthalpy of steam.
$T_{FW,i}$	Feed water temperature	Daily	Shift basis	79.43 degree C (average of shift wise data)	105 degree C (design feed water temperature)
$E_{FW,i}$	Enthalpy of feed water	Daily	Shift basis	79.43 kcal/kg (average of shift wise data)	105 kcal/kg
EF_{CO2}	Coal emission factor	IPCC default value and it is fixed ex-ante	-	-	96.1 tCO_2/ TJ
η_{th}	The efficiency of the baseline coal fired boiler	IPCC default value and it is fixed ex-ante	-	-	100%

The baseline emission for the monitoring period is calculated as below:

Step-1: *Calculation of* ***HG_y (net quantity of steam supplied by the project activity in TJ)***

= Quantity of steam generated in tonnes ×1000 × (Enthalpy of steam in kcal/kg – Feed water enthalpy in kcal/kg) × 4.1868 /10^9

= 197.78TJ

Step-2: *Calculation of Baseline emission in tCO_2*

*= {HG_y in TJ*Coal emission factor in tCO_2/TJ}/Efficiency of the baseline coal fired boiler in %*

= {197.78 TJ * 96.1 tCO_2/TJ}/100%

= 19007tCO_2 (Rounding down)

The monthly breakup of the baseline emission is tabulated below:

Month	Baseline emission tCO_2
Apr-09(From 25th April 2009)	424.60
May-09	1940.38
Jun-09	1061.51
Jul-09	2193.48
Aug-09	2193.19
Sep-09	2122.38
Oct-09	2193.48
Nov-09	2123.02
Dec-09	2193.79
Jan-10	2193.79
Feb-10 (till 5th February 2010)	367.45

Project Emission

There are no project activity emissions as this is a renewable project activity. No fossil fuel was fired in the boiler during the monitoring period. Hence Project emission on account of use of fossil fuel is:

$$PE_{FC,j,y} = \sum FC_{i,j,y} * COEF_{i,y}$$

Since $\Sigma FC_{i,j,y} = 0$ project emission is 0 tCO_2e

Leakage

Leakages (Ly):

A. leakage estimation has been done **as per the "General guidance on leakage in biomass project activities, Version 02, EB 28[1]"**

Sterling Agro Industries Ltd. has carried out its own assessment through external experts. PP appointed a consultant "Enviroaid" for the Biomass assessment study. The assessment was conducted in a radius of 100 km from the plant site. It is evident from the assessment study that rice husk is available in surplus in the study area and surplus percentage is 110% including the rice husk consumption in this project activity.

There are enough biomass residues available in the region that goes unutilized and hence leakage emissions on account of competing use of this biomass residue has not been considered.

Rice husk generation in the study area	Rice husk consumption in the study area	Rice husk requirement in the project activity	Surplus available	Total rice husk utilized including project activity	Rice husk availability
MT/annum	MT/annum	MT/annum	MT/annum	MT/annum	%
278234	99567	32760[3]	145907	132327	110%

B. Leakage due to transfer of equipments to/ from the project activity

As per the methodology, if the equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. The equipments installed in the project activity are not transferred from any other activity. Besides, no existing equipment has been transferred from the project site. Hence leakage for this part is zero.

C. Leakage due to transportation of biomass to the plant site

The project activity is not expected to cause any leakage emissions due to transportation of biomass; rather it is expected to result in reduced leakage emissions due to reduced transportation of fuel. In the pre-project scenario coal was procured from the mines located at a distance of around 300-350 kms from the project site, where as in the post project scenario the project activity the biomass is procured from in a region of max 100 kms from the project site. However being conservative the project proponent is not claiming any emission reductions due to reduced fuel transportation.

6. Emission Reductions:

Baseline emission:

SN	Month	Quantity of steam generated tonnes	Baseline emission in tCO_2
1	Apr-09 (From 25th April 2009)	1872	424.60
2	May-09	8556	1940.38
3	Jun-09	4680	1061.51
4	Jul-09	9672	2193.48
5	Aug-09	9672	2193.13
6	Sep-09	9360	2122.38
7	Oct-09	9672	2193.48
8	Nov-09	9360	2123.02
9	Dec-09	9672	2193.79
10	Jan-10	9672	2193.79
11	Feb-10 (till 5th February 2010)	1620	367.45

[3] The current monitoring period is for 286 days. The rice husk consumption in the monitoring period is 25670MT. The husk consumption prorated for 365 days is 32760MT.

Total	**19007**

Project Emissions

Since no fossil fuel is used in the project activity project emissions is zero.

Leakage:
As discussed above the project activity is not expected to cause any leakage emissions; this component is zero.

Emission Reductions = Baseline Emissions – Project Emissions- Leakage emissions

Emission reduction:

Month	Estimation of project activity emissions (tCO_2 e)	Estimations of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
Apr-09 (From 25th April 2009)	0	424.60	0	424.60
May-09	0	1940.38	0	1940.38
Jun-09	0	1061.51	0	1061.51
Jul-09	0	2193.48	0	2193.48
Aug-09	0	2193.13	0	2193.13
Sep-09	0	2122.38	0	2122.38
Oct-09	0	2193.48	0	2193.48
Nov-09	0	2123.02	0	2123.02
Dec-09	0	2193.79	0	2193.79
Jan-10	0	2193.79	0	2193.79
Feb-10 (till 5th February 2010)	0	367.45	0	367.45
Total	**0**	**19007**	**0**	**19007***

*Rounded down

The total emission reductions for the monitoring period are 19007 tCO_2.

7. Quality Control (QC) and Quality Assurance (QA)
Sterling Agro Industries Ltd has the following structure for data monitoring, collection, data archiving, and calibration of metering equipments. The team comprises of the following members:

- Head
- Plant In-charge
- Shift In-charge

Responsibilities of Head: Overall functioning and maintenance of the project activity.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipments).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

Personnel training: In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained to enable them

undertaking necessary tasks in a transparent and credible approach. The operator personnel will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

Data collection and record keeping: Data will be collected at the plant operation site under the supervision of the shift-in-charge and records will be maintained in daily logs. The reports are checked periodically by the Plant In-charge and discussed thoroughly with the data monitoring personnel. A separate log will also be maintained for the biomass supply on the site, its storage and usage in the project activity.

Reliability of data collected: The reliability of the measuring equipments will be calibrated and documents pertaining to calibration of equipments shall be maintained by Plant In-charge.

Calibration of Measuring Instruments:

Pressure and Temperature gauges and flow meters of Boiler and form a part of the monitoring system of the project activity. The details of the meters are given below:

Meter Type	Date of calibration	Calibration due on	Serial No	Make	Accuracy Class	Calibration Agency	Calibartion certificate reference number
Temperature* Gauge – Steam	26-02-2009	25-02-2010	7046215	Masibus	±0.2%FS	Classic instrumentation Pvt Ltd.	CI/2K9-2K10/SR 5208
	25-02-2010	24-02-2011					CI/2K9-2K10/SR19435
Temperature* Gauge – Feed water	26-02-2009	25-02-2010	7046215	Masibus	±0.2%FS	Classic instrumentation Pvt Ltd.	CI/2K9-2K10/SR 5208
	25-02-2010	24-02-2011					CI/2K9-2K10/SR 19435
Pressure gauge-Steam	26-02-2009	25-02-2010	408P601	Forbes	±1%FS	Classic instrumentation Pvt Ltd.	CI/2K9-2K10/SR 5209
Steam flow meter	26-02-2009	25-02-2010	2k8060227	Forbes	±0.2% FS	Classic instrumentation Pvt Ltd.	CI/2K9-2K10/SR 5210
	25-02-2010	24-02-2011					CI/2K9-2K10/SR19437
Digital Bomb Calorimeter	24-07-2008	23-07-2009	017-02-03	Rajdhani	±0.01% FS	Classic instrumentation Pvt Ltd.	CI/2K9-2K10/SR4606
	21-07-2009	20-07-2010					CI/2K9-2K10/SR 5304
Weighing balance/ indicator	24-04-2009	23-04-2010	EB08MR051	Avery	±0.003 Ton	Galaxy test & calibration Lab	GTCL/GE/09-10/15615

*The same digital temperature scanner was used to monitor both steam temperature and feed water temperature

.
The reliability of the meters and gauges are checked by calibrating the meters on a yearly basis. Documents pertaining to calibration of meters are maintained at the site.

8. Approval and consents:

Project proponent obtained all the required Approvals and consents from the concerned departments well before the commissioning of the plant and the consent were also renewed periodically. PP obtained consent to establish on 23rd March 2009 and consent to operate under Water and air act for 1st January 2009 to 31st December 2009 and renewed on 1st January 2010which is having the validity up to 31st December 2010. Similarly PP has also obtained boiler steam test certificate from the directors of boiler on 25th August 2009 which is valid till 24th August 2010. Also the hydraulic test certificate for the boiler was obtained on 14th January 2009.

Variation from estimated ER

Monitored VERs in tCO2 e for a period 25/04/09 to 05/02/10	Estimated VERs as per registered PDD	Difference in the VERs in tCO2 e	Percentage difference in VERs
19007	16402.94*	2604.05	%15.876%

*Estimated emission reduction for same vintage.

Reasons for variation in CERs :

In the registered PDD, Emission reduction was estimated considering 70% PLF but for this monitoring period 85% PLF was achieved which results in the higher ER for this period. There was no lean period observed in the entire monitoring period and there was no major shut down, (except for 15 days in June first week for maintenance purpose.). The plant was operated continuously from the date of commissioning. Hence achieved PLF is higher than the PLF considered in the registered PDD.

Further this is in line with the registered PDD where PLF for both Baseline and project scenario was considered same. Thus increase in PLF has no any impact on the credential of additionality.

Annex 1

Baseline Emissions

As per the methodology, baseline emissions for this case should be calculated as:

$BEy = HGy * EFCO_2 / \eta th$

Where;

BE_y	= the baseline emissions from steam displaced by the project activity during the year y in tCO_2e.
HG_y	= the net quantity of steam supplied by the project activity during the year y in TJ.
$EFCO_2$	= the CO2 emission factor per unit of energy of the coal that would have been used in the baseline plant in (tCO_2 / TJ), IPCC default emission factor is used (96.1 tCO_2/TJ).
η_{th}	= the efficiency of the boiler using coal that would have been used in the absence of the project activity.

Project Emission

There are no project activity emissions as this is a renewable project activity. However, small quantity of fossil fuel would be used for start up the boiler and as co-firing in the project activity. Project emissions on account of use of fossil fuel would be considered and monitored as per the "**Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", version-02, EB41.**

Project Emissions due to Auxiliary Fuel (e.g. Coal) Consumption is estimated as per the following equation:

$$PE_{FC,j,y} = \sum FC_{i,j,y} * COEF_{i,y}$$

Where;

PE_{FC},j,y	Are the CO_2 emissions from fossil fuel combustion in process j during the year *y* (tCO_2/yr)
FCi,j,y	the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr)
$COEFi,y$	the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	the fuel types combusted in process *j* during the year *y.*

The CO_2 emission coefficient $COEFi,y$ is calculated based on net calorific value and CO2 emission factor of the fuel type *i*, as follows:

$$COEFi,y = NCVi,y * EFCO2,i,y$$

Where,

$COEF_{i,y}$	the CO_2 emission coefficient of fuel type i in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EFCO_{2,i,y}$	the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
i	the fuel types combusted in process *j* during the year *y*

Leakage

Leakages (L_y):

Leakage estimation has been done **as per the "General guidance on leakage in biomass project activities, Version 02, EB 28"**

The project activity proposes using surplus biomass (rice husk) available surplus in the region. The guidance has highlighted three distinct possibilities of leakage in biomass usage.

Biomass type	**Activity/source**	**Shift of pre-**	**Emission from**	**Competing**

		project activities	biomass generation/cultivation	use of biomass
Biomass from forest	Existing forest	-	-	×
	New forest	×	×	-
Biomass from croplands or grasslands (woody or non woody)	In the absence of the project the land would be used as cropland/wasteland	×	×	-
	In the absence of the project activity land would be abandoned	-	×	-
Biomass residues or wastes*	Biomass residues or wastes are collected and used	-	-	×

*Applicable to the project activity.

The project activity involves procurement of biomass residue available in the region. The biomass would be procured from selected parts of Aligarh, Mathura, Agra, Hathras, Firozabad, Mainpuri, Bareilly and Etah districts constituting Agra Mandal and area covered within 90 km radius from Etah district. For this as per the guidance, the project participant shall evaluate annually if there is a surplus of the biomass in the region of the project activity, which is not utilized. It will be demonstrated using published literature, official reports, surveys etc. that the quantity of available biomass in the region, is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions.

There is enough biomass residue available in the region that goes unutilized and hence leakage emissions on account of competing use of this biomass residue has not been considered. However, this will be monitored annually which will be available during verification.

In case when the biomass residues available in the region is not at least 25% higher than the quantity of biomass that is utilized including the project activity, following procedure would be adopted for estimation of leakage-

$Ly = EF_{CO2,LE} * \Sigma BF_{k,y} * NCV_k$

L_y = Leakage emissions during year y, tCO_2
$EF_{CO2, LE}$ = CO_2 emission factor of the most carbon intensive fuel used in the country, tCO_2/ GJ, National Emission Factor Value (0.1062 tCO_2/GJ for Lignite)
$BF_{k,y}$ = Quantity of biomass residue k used in project activity not available in surplus in the region in year y
NCV_k = Net calorific value of biomass residue k, GJ/ tone

B. Leakage due to transfer of equipments to/ from the project activity
As per the methodology, if the equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. The equipments

installed in the project activity are not transferred from any other activity. Besides, no existing equipment has been transferred from the project site. Hence leakage for this part is zero.

C. Leakage due to transportation of biomass to the plant site

The project activity is not expected to cause any leakage emissions due to transportation of biomass; rather it is expected to result in reduced leakage emissions due to reduced transportation of fuel. In the pre-project scenario coal was procured from the mines located at a distance of around 300-350 kms from the project site, where as in the post project scenario the project activity the biomass is procured from in a region of max 100 kms from the project site. However being conservative the project proponent is not claiming any emission reductions due to reduced fuel transportation.

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